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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/992,479	11/13/2001	Xinqiao Liu	S01-019/US	1467

30869 7590 07/28/2005

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EXAMINER
DANIELS, ANTHONY J

ART UNIT	PAPER NUMBER
2615	

DATE MAILED: 07/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/992,479	LIU ET AL.
	Examiner	Art Unit
	Anthony J. Daniels	2615

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 April 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *33 and 34* is/are allowed.

6)☒ Claim(s) *1-16,19-32,35 and 36* is/are rejected.

7)☒ Claim(s) *17,18* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendment, filed 4/29/2005, has been entered and made of record. Claims 1-36 are pending in the application.

2. The applicant's amendment to the numbering of the claims has overcome the examiner's objection.

Response to Arguments

3. Applicant's arguments with respect to claims 25-27 have been considered but are moot in view of the new ground(s) of rejection.

4. Applicant's arguments, filed 4/29/2005, have been fully considered but they are not persuasive. In regard to the arguments on p.12, Lines 22-31; p.13, Lines 1-23 (Claims 25-27), the examiner respectfully disagrees. On p.13, Lines 5-10, applicant contends, "...Trevino neither teaches nor describes "an estimation means" identical to and in as complete detail as is contained in the claim. The cited paragraph [0048] mentions nothing about an estimation means capable of determining an estimated illumination on an image sensor from a multiplicity of measurements. Rather, step 412 of Trevino merely suggests "processing" at most two integration values, based on a weighted average there between, to arrive at an output signal..." Trevino et al. teaches a pre-processing unit which performs a weighted average of two successive pixel values from the same unit cell of a CMOS image sensor ([0032], Lines 1-8; [0048]). Although the pre-processing

unit is not explicitly stated as an estimation means, the pre-processing unit performs the identical function as set forth in claims; just because the language is not the same, does not mean the means are different. The same argument applies for the estimated illumination and multiplicity of measurements. The output of the weighted average is termed "output signal" in Trevino et al., where the output of the weighted average is termed "estimated illumination" in the present application. Two integration values of successive frames are equivalent to a multiplicity of measurements. In regard to the arguments on p.13, Lines 26-30; p.14; p.15, Lines 1-14 (Claims 1-3,8-10,15,28), the examiner respectfully disagrees. On p. 14, Lines 6-10, applicant contends, "...it is not clear how, from a single paragraph of Yoshida and in view of Trevino, one of ordinary skill in the art could have arrived at a sensor capable of capturing non-destructively a plurality of image samples during an exposure period and performing optimal illumination estimation on the sensor from those multiple captures..." The examiner has relied on Yoshida, simply to show the non-destructive readout type sensor, which he does, as conceded by applicant on p. 14, Line 6. The advantages of a non-destructive readout type sensor are well known in the art and are set forth in the previous office action (see Non-Final Rejection, Claim 1 rejection). All other limitations, allegedly at issue, can be found in Trevino et al. On p.14, Lines 27,28, applicant further contends, "...Trevino lacks detailed description on performing a (non-recursive) optimal illumination estimation on a sensor from multiple (two or more) captures..." The weighted averaging of Trevino et al. is performed in a non-recursive manner. The output signal is arrived at via <u>one</u> weighted averaging between two pixel values (Vout1 and Vout2). It is not continuously or circulatively performed. On p.15, Lines 4-14, applicant further contends, "...Pucker and Sezan use the term "pixel" to refer to the basic unit of an image sensor, not of an

image sensor…" A pixel of an image sensor is the same as a pixel defined as the basic unit of an image. The basic unit of an image cannot exist if it weren't for the image sensor that creates the image. The basic unit of an image may be in digital form, but it is the digital form of a pixel of an image sensor. In regard to arguments on p.15, Lines 17-31; p.16; p.17, Lines 1-11 (Claims 16,19,20,24), the examiner respectfully disagrees. On p.16, Lines Applicant simply contends that "…Hidari does not teach or suggest recursively estimating an optimal illumination on a sensor from multiple image samples non-destructively captured during a single exposure in which all or essentially all samples before saturation are used…" As set forth in claim 16 of the previous office action, Hidari teaches circulatively (i.e. recursively) adding K times the input video signal to continually gain a closer estimate (as noise free as possible) of a natural image of a motion picture (Col. 2, Lines 65-67; Col. 3, Lines 1-6). Although it is not stated as explicitly as the claim of the present application, Hidari anticipates the limitations of the claim, except for those taught by Yoshida. On p.16, Lines 8-10, applicant further contends, "…neither Hidari nor Yoshida mention CMOS image sensors. Thus, the inherent features of CMOS image sensors do not flow from the combined teachings of Hidari and Yoshida…" It is respectfully submitted that none of the limitations of claims 16,19,20,24 recite any language of CMOS image sensors. It is believed that the examiner has addressed all arguments from applicant.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1-3,8-11,15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (US 20020012056) in view of Yoshida (JP-63-201406).

As to claim **1**, Trevino et al. teaches an estimation method for estimating illumination sensor capable of capturing a plurality of image samples during an exposure period, said method comprising the steps: measuring an illumination indication from said sensor, measuring occurs two or more times at intervals during said exposure period, producing a multiplicity of measurements (see [0032], Lines 8-12; [0048]); and determining, based on an optimal weighted averaging process, an estimated illumination on said sensor from said multiplicity of measurements (see [0048], Lines 1-8, "...final output signal..."; *{The examiner interprets the weighted averaging of Trevino et al. to be optimal, because it gives greater dynamic range.}*). The claim differs from Trevino et al. in that it further requires that the plurality of image samples be captured non-destructively.

In the same field of endeavor, Yoshida teaches a non-destructive read-type imager for capturing plural images (see Purpose, Lines 1-3). In light of the teaching of Yoshida, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the image sensor of Trevino et al. to output non-destructive image signals. Such a modification would allow for a more accurate approach to image sampling, since more samples would be made available for processing.

As to claim **2**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 1, wherein said sensor is a photodiode (see Trevino et al., Figure 2, node "254"; *{The node which collects light performs the same function as a photodiode.}*) and said illumination

indication is a charge accumulated from photocurrent produced by said photodiode (*This is an inherent feature of CMOS image sensors.*).

As to claim **3**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 2, wherein said measuring step occurring non-destructively (see Yoshida, Purpose, Lines 1-3) and said charge accumulating over said exposure period (*This is an inherent feature of CMOS image sensors.*).

As to claim **8**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 1, wherein said sensor is configured in a sensor array, a pixel sensor in a digital camera, a pixel sensor in a video camera, a pixel sensor in a stereo digital camera, or a pixel sensor in a stereo video camera (see Trevino et al., [0052], Lines 1-4).

As to claim **9**, Trevino et al. teaches an estimation method for non-recursively estimating an optimal illumination on a sensor capable of capturing a plurality of image samples during an exposure period, said method comprising the steps of: measuring an illumination indication from said sensor (see [0032], Lines 8,9); storing said illumination indication (see [0032], Lines 9,10), wherein said measuring and storing steps occur two or more times during said exposure period, collecting non-destructively a multiplicity of measurements (see [0032], Lines 9-15); and performing a non-recursive optimal illumination estimation on said sensor from all or essentially all of said collected multiplicity of measurements (see [0048], Lines 1-4, "...final output signal..."). The claim differs from Trevino et al. in that it further requires that the plurality of image samples be captured non-destructively.

In the same field of endeavor, Yoshida teaches a non-destructive read-type imager for capturing plural images (see Purpose, Lines 1-3). In light of the teaching of Yoshida, it would

have been obvious to one of ordinary skill in the art at the time the invention was made to modify the image sensor of Trevino et al. to output non-destructive image signals. Such a modification would allow for a more accurate approach to image sampling, since more samples would be made available for processing.

As to claim **10**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 9, wherein said sensor is a photodiode (see Trevino et al., Figure 2, node "254"; *{The node which collects light performs the same function as a photodiode.}*) and said illumination indication is a charge accumulated from photocurrent produced by said photodiode (*This is an inherent feature of CMOS image sensors.*).

As to claim **11**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 10, wherein said measuring step occurring non-destructively (see Yoshida, Purpose, Lines 1-3) and said charge accumulating over said exposure period (*This is an inherent feature of CMOS image sensors.*).

As to claim **15**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 9, wherein said sensor is configured in a sensor array, a pixel sensor in a digital camera, a pixel sensor in a video camera, a pixel sensor in a stereo digital camera, or a pixel sensor in a stereo video camera (see Trevino et al., [0052], Lines 1-4).

6. Claims 4,36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (see Patent Number above) in view of Yoshida (see Patent Number above) in view of Pucker, II et al. (US # 6,298,144).

It is noted that the USPTO considers the language "selected from" to mean any one of the corresponding elements upon which selection is to be made.

As to claim **4**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 1, and statistical signal processing of said multiplicity of measurements (see [0048], Lines 8-10). The claim differs from Trevino et al., as modified by Yoshida, in that it further requires that said signal processing be based on a noise model selected from a fixed pattern noise model, a reset noise model, a shot noise model, and a read noise model.

In the same field of endeavor, Pucker II, et al. teaches the use of a median filter (see Figure 2, median filter "37"; Col. 4, Lines 47-49; *{Median Filters have principal use in eliminating shot noise.}*). In light of the teaching of Pucker II, et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a median filter in the determining step of Trevino et al., as modified by Yoshida, because an artisan of ordinary skill in the art would recognize that such a filter can effectively remove shot noise, which can cause considerable degradation in image quality.

As to claim **36**, the limitations in claim 36 can be found in claim 4. Therefore, claim 36 is analyzed and rejected as previously discussed with respect to claim 4.

7. Claims 5-7,12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (see Patent Number above) in view of Yoshida (see Patent Number above) and further in view of Sezan et al. (US # 5,600,731).

As to claim **5**, Trevino et al., as modified by Yoshida, teaches the estimation method of claim 1 and statistical signal processing of said multiplicity of measurements (see [0048], Lines

8-10). The claim differs from Trevino et al., as modified by Yoshida, in that it further requires signal processing be based on maximizing a likelihood of accuracy of said estimated illumination.

In the same field of endeavor, Sezan et al. teaches linear minimum means square error estimates on noisy images (Col. 2, Lines 60-68; Col. 3, Lines 1-24; Col. 13, Lines 9-26; *{Maximizing the likelihood of accuracy is being interpreted as minimizing the error.}*). In light of the teaching of Sezan et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the statistical signal processing of Trevino et al., as modified by Yoshida, to include linear minimum mean square error as a way of maximizing the likelihood of accuracy of the estimated illumination, because an artisan of ordinary skill in the art would recognize that linear minimum mean square error provides a more accurate and robust way of suppressing noise error in images.

As to claim **6**, the limitations of claim 6 can be found in claim 5. Therefore, claim 6 is analyzed and rejected as previously discussed with respect to claim 5. *Maximizing the likelihood of accuracy is being interpreted as minimizing the error.*

As to claim **7**, the limitations of claim 7 can be found in claim 5. Therefore, claim 7 is analyzed and rejected as previously discussed with respect to claim 5. *Maximizing the likelihood of accuracy is being interpreted as minimizing the error.*

As to claim **12**, the limitations of claim 12 can be found in claim 5. Therefore, claim 12 is analyzed and rejected as previously discussed with respect to claim 5.

As to claim **13**, the limitations of claim 13 can be found in claim 6. Therefore, claim 13 is analyzed and rejected as previously discussed with respect to claim 6.

As to claim **14**, the limitations of claim 14 can be found in claim 7. Therefore, claim 14 is analyzed and rejected as previously discussed with respect to claim 7.

8. Claims 16,19,20,24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hidari (US # 5,905,533) in view of Yoshida (see Patent Number above).

As to claim **16**, Hidari teaches an estimation method for recursively estimating an optimal illumination on a sensor (see Col. 2, Lines 38-42) capable of capturing a plurality of image samples during an exposure period (see Col. 2, Lines 65-67; Col. 3, Lines 1-6), said method comprising the steps of: measuring an illumination indication from said sensor (see Col. 2, Lines 65-67), said measuring occurs two or more times at intervals during said exposure period (see 2, Lines 65-67; Col. 3, Lines 1-6; "...past image signal..."); and determining an estimated illumination on said sensor from all or essentially all of said multiplicity of measurements non-destructively captured before motion/saturation (see Col. 2, Lines 33-37, "...stop value."; *{It is inherent that motion blur or saturation has not occurred when the measurements are taking place, because, if it were true, it would leave Hidari unfit for its purposes.}*), said determining step occurring recursively (see Col. 2, Line 66, "...circulatively...") over said multiplicity of measurements and including statistical signal processing of said multiplicity of measurements, said signal processing being based on a noise model selected from a fixed pattern noise model, a reset noise model, a shot noise model and a read noise model (see Col. 1, Lines 42,43; *{This type of noise is read-out noise.}*). *The language "thereby collecting a multiplicity of measurements" is an inherent consequence of the sampling process.* The claim differs from Hidari in that it further requires that the plurality of image samples be captured non-destructively.

In the same field of endeavor, Yoshida teaches a non-destructive read-type imager for capturing plural images (see Purpose, Lines 1-3). In light of the teaching of Yoshida, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the image sensor of Hidari to output non-destructive image signals. Such a modification would allow for a more accurate approach to image sampling, since more samples would be made available for processing.

As to claim **19**, Hidari, as modified by Yoshida, teaches the estimation method of claim 16, wherein said illumination indication is a charge accumulated from a produced photocurrent. Hidari, as modified by Yoshida, does not specifically teach the sensor as a photodiode. **Official Notice** is taken that both the concept and advantages of using a photodiode as an image sensor are well known and expected in the art. It would have been obvious to one of ordinary skill in the art to use a photodiode as the image sensor in the image processing apparatus of Hidari, because photodiodes are much smaller than other image sensing devices and can be mass implemented on a single substrate.

As to claim **20**, Hidari, as modified by Yoshida, teaches the estimation method of claim 16, wherein said measuring step occurring non-destructively (see Yoshida, Purpose, Lines 1-3) and said charge accumulating over said exposure period (*This is an inherent feature of CMOS image sensors.*).

As to claim **24**, Hidari, as modified by Yoshida, teaches the estimation method of claim 16, wherein said sensor is configured in a sensor array, a pixel sensor in a digital camera, a pixel sensor in a video camera, a pixel sensor in a stereo digital camera or a pixel sensor in a stereo video camera (see Trevino et al., [0052], Lines 1-4).

9. Claims 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hidari (see Patent Number above) in view of Yoshida (see Patent Number above) and further in view of Sezan et al. (see Patent Number above).

As to claim **21**, Hidari, as modified by Yoshida, teaches the estimation method of claim 16 and statistical signal processing of said multiplicity of measurements (see Col. 1, Lines 42,43). The claim differs from Trevino et al., as modified by Yoshida, in that it further requires signal processing be based on maximizing a likelihood of accuracy of said estimated illumination.

In the same field of endeavor, Sezan et al. teaches linear minimum means square error estimates on noisy images (see Abstract, Lines 8-11; *{Maximizing the likelihood of accuracy is being interpreted as minimizing the error.}*). In light of the teaching of Sezan et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the statistical signal processing of Hidari, as modified by Yoshida, to include linear minimum mean square error as a way of maximizing the likelihood of accuracy of the stop value, because an artisan of ordinary skill in the art would recognize that linear minimum mean square error provides a more accurate and robust way of suppressing noise error in images.

As to claim **22**, the limitations of claim 22 can be found in claim 21. Therefore, claim 22 is analyzed and rejected as previously discussed with respect to claim 21. *Maximizing the likelihood of accuracy is being interpreted as minimizing the error.*

As to claim **23**, the limitations of claim 23 can be found in claim 21. Therefore, claim 23 is analyzed and rejected as previously discussed with respect to claim 21. *Maximizing the likelihood of accuracy is being interpreted as minimizing the error.*

10. Claims 25-27,30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (US # 20020012056) in view of Sezan et al. (5,600,731).

As to claim **25**, Trevino et al. teaches an apparatus configured to estimate illumination on a sensor during an exposure period, said apparatus comprising: a sampling means configured to measure an illumination indication, at two or more time intervals during said exposure period, and to produce a multiplicity of measurements thereof (see [0032], Lines 8-12); a linear mean square estimation means configured to derive optimal weights from said multiplicity of measurements; and an estimation means configured to determine, based on weighted averaging, an estimated illumination on said sensor from said multiplicity of measurements (see [0048], Lines 1-8). The claim differs from Trevino et al. in that it further requires a linear mean square estimation means configured to derive optimal weights from said multiplicity of measurements and that said estimation means uses said optimal weights in weighted averaging.

In the same field of endeavor, Sezan et al. teaches linear minimum mean square error estimates on a sequence of images (Col. 2, Lines 60-68; Col. 3, Lines 1-24; Col. 13, Lines 9-26). In light of the teaching of Sezan et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to include the linear minimum mean square error estimation means of Sezan et al. to derive the weights for the pixel values of Trevino et al., because an artisan of ordinary skill in the art would recognize that linear minimum mean square error provides a more accurate and robust way of suppressing noise error in images.

As to claim **26**, Trevino et al., as modified by Sezan et al., teaches the apparatus of claim 25, wherein said sensor is implemented in a sensor array, a pixel sensor in a single chip imaging

device, a pixel sensor in a digital camera, pixel sensor in a video camera, a pixel sensor in a stereo digital camera, or a pixel sensor in a stereo video camera (see [0052], Lines 1-4).

As to claim **27**, Trevino et al., as modified by Sezan et al., teaches the apparatus of claim 25, wherein said sensor is a photodiode (see Figure 2, node "254"; *{The node which collects light performs the same function as a photodiode.}*) and said illumination indication is a charge accumulated from photocurrent produced by photodiode (*This an inherent feature of CMOS image sensors.)*.

As to claim **30**, Trevino et al., as modified by Sezan et al., teaches the apparatus of claim 25, wherein said estimation means being configured to perform statistical signal processing of said multiplicity of measurements (see [0048], Lines 8-10). The claim differs from Trevino et al., as modified by Sezan et al., in that it further requires signal processing be based on maximizing a likelihood of accuracy of said estimated illumination.

In the same field of endeavor, Sezan et al. teaches linear minimum means square error estimates on noisy images (Col. 2, Lines 60-68; Col. 3, Lines 1-24; Col. 13, Lines 9-26; *{Maximizing the likelihood of accuracy is being interpreted as minimizing the error.}*). In light of the teaching of Sezan et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the statistical signal processing of Trevino et al. to include linear minimum mean square error as a way of maximizing the likelihood of accuracy of the estimated illumination, because an artisan of ordinary skill in the art would recognize that linear minimum mean square error provides a more accurate and robust way of suppressing noise error in images.

As to claim **31**, the limitations of claim 31 can be found in claim 30. Therefore, claim 31 is analyzed and rejected as previously discussed with respect to claim 30. *Maximizing the likelihood of accuracy is being interpreted as minimizing the error.*

As to claim **32**, the limitations of claim 32 can be found in claim 30. Therefore, claim 32 is analyzed and rejected as previously discussed with respect to claim 30. *Maximizing the likelihood of accuracy is being interpreted as minimizing the error.*

11. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (see Patent Number above) in view of Sezan et al. (see Patent Number above) and further in view of Yoshida (see Patent Number above).

As to claim **28**, Trevino et al., as modified by Sezan et al., teaches the apparatus of claim 25 wherein said charge accumulates over said exposure period (*This is an inherent feature of CMOS image sensors.*). The claim differs from Trevino et al. in that it further requires that said sampling means operates non-destructively.

In the same field of endeavor, Yoshida teaches a non-destructive read-type imager for capturing plural images (see Purpose, Lines 1-3). In light of the teaching of Yoshida, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the image sensor of Trevino et al., as modified by Sezan et al., to output non-destructive image signals, because an artisan of ordinary skill in the art would recognize that such a modification would allow for a more accurate approach to image sampling, since more samples would be made available for processing.

12. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (see Patent Number above) in view of Sezan et al. (see Patent Number above) and further in view of Pucker, II et al. (see Patent Number above).

As to claim **29**, Trevino et al. teaches the apparatus of claim 25, wherein said estimation means being configured to perform statistical signal processing of said multiplicity of measurements (see [0048], Lines 6-8). The claim differs from Trevino et al. in that it further requires that said signal processing be based on a noise model selected from a fixed pattern noise model, a reset noise model, a shot noise model and a read noise model.

In the same field of endeavor, Pucker II, et al. teaches the use of a median filter (see Figure 2, median filter "37"; Col. 4, Lines 47-49; *{Median Filters have principal use in eliminating shot noise.}*). In light of the teaching of Pucker II, et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a median filter in the statistical signal processing of Trevino et al., because an artisan of ordinary skill in the art would recognize that such a filter can effectively remove shot noise, which can cause considerable degradation in image quality.

13. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Trevino et al. (see Patent Number above) in view of Pucker, II et al. (see Patent Number above).

As to claim **35**, Trevino et al. teaches an apparatus configured to estimate illumination on a sensor during an exposure period (see [0048], Lines 1-3) for improving dynamic range (see Title), where said sensor is configured in a complementary metal oxide semiconductor (CMOS) image sensor system (see Figure 2) capable of capturing multiple image samples during said

exposure period (see [0032], Lines 7,8), said apparatus comprising: means for measuring, at a multiplicity of intervals during said exposure period, actual photocurrent from said sensor (see [0032], Lines 7,8) said means for measuring thereby producing a multiplicity of photocurrent measurements (see [0032], Lines 7,8); and means for estimating optimal photocurrent on said sensor from said multiplicity of measurements (see [0048], Lines 1-3, "...final output value..."). The claim differs from Trevino et al. in that it requires that the apparatus reduce noise while improving dynamic range at the low illumination end.

In the same field of endeavor, Pucker II, et al. teaches reducing noise and simultaneously improving dynamic range at the low illumination end (see Figure 2, median filter "37"; Col. 4, Lines 47-49; *{Median Filters have principal use in eliminating shot noise; furthermore, improvement of dynamic range at the low illumination end is a direct consequence of noise reduction.}*). In light of the teaching of Pucker II, et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to reduce noise in the sensor of Trevino et al. while simultaneously improving dynamic range at the low illumination end, because an artisan of ordinary skill in the art would recognize that such a reduction would allow for a more accurate and natural final output value.

Allowable Subject Matter

<u>**Note for allowable subject matter**</u>**: In the previous office action claims 34,35 were indicated allowed and claims 18,19 were indicated allowable. In the amendment dated 4/29/2005, the claims were renumbered making claim 34 and 35 become claims 33 and 34, respectively, and claims 18 and 19 became claims 17 and 18, respectively.**

14. Claims 33,34 are allowed.

15. Claims 17,18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The reasons for indicating allowable subject matter can be found in the previous office action.

Conclusion

16. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anthony J. Daniels whose telephone number is (571) 272-7362. The examiner can normally be reached on 8:00 A.M. - 4:30 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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7/20/05

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